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Abstract. There are many types of indoor and outdoor navigation tools and methodologies available. A majority of these solutions are based on Global Positioning Systems (GPS) and instant video and image processing. These approaches are ideal for open world environments where very few information about the target location is available, but for large scale building environments such as hospitals, governmental offices, etc the end-user will need more detailed information about the surrounding context which is especially important in case of people with special needs. This paper presents a smart indoor navigation solution that is based on Semantic Web technologies and Building Information Model (BIM). The proposed solution is also aligned with Google Android's concepts to enlighten the realization of results.

Keywords: IAI IFCXML, Building Information Model, Indoor Navigation, Semantic Web, Google Android, People with Special Needs

1 Introduction

Built environment is a central factor in our daily life and a big portion of human life is spent inside buildings. Traditionally the buildings are documented using building maps and plans by utilization of IT tools such as computer-aided design (CAD) applications. Documenting the maps in an electronic way is already pervasive but CAD drawings do not suffice the requirements regarding effective building models that can be shared with other building-related applications such as indoor navigation systems. The navigation in built environment is not a new issue, however with the advances in emerging technologies like GPS, mobile and networked environments, and Semantic Web new solutions have been suggested to enrich the traditional building maps and convert them to smart information resources that can be reused in other applications and improve the interpretability with building inhabitants and building visitors.

Other important issues that should be addressed in building navigation scenarios are location tagging and end-user communication. The available solutions for location tagging are mostly based on proximity sensors and the information are bound to sensor references. In the proposed solution of this paper, the sensors simply play a role similar to annotations in Semantic Web world. Hence the sensors data in ontology sense bridges the gap between sensed information and building model. Combining these two and applying the proper inference rules, the building visitors will be able to reach their destinations with instant support of their communication devices such as hand helds, wearable computers, mobiles, etc.

In a typical scenario of this kind, user's profile will be delivered to the smart building (via building ad-hoc services) and the appropriate route for user will be calculated and delivered to user's end-device. The calculated route is calculated by considering all constraints and requirements of the end user. So for example if the user is

using a wheelchair, the calculated route should not contain stairs or narrow corridors that the wheelchair does not pass through. Then user starts to navigate through building by following the instructions of the end-device which are in turn generated from the calculated route. During the navigation process, the end-device should also interact with the smart building to sense the locations by reading the surrounding tags. So for example when a visually impaired person arrives at an unknown space, the tags will be sensed and the relevant information will be delivered to user in the proper way of communication. For example the building model can be used to generate a voice message for a blind person about a space and tell him/her that "the space has 3 doors, and the door on the left should be chosen which needs to be pushed to open".

In this paper we will mainly focus on automatic generation of semantic building information models (Semantic BIM) and delivery of results to the end user. Combining the building information model with the environment and user constraints using Semantic Web technologies will make many scenarios conceivable. The generated IFC ontology that is base on the commonly accepted IFC (Industry Foundation Classes) standard can be used as the basis of information sharing between buildings, people, and applications. The proposed solution is aiming to facilitate the building navigation in an intuitive and extendable way that is easy to use by end-users and at the same time easy to maintain and manage by building administrators.